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Statistical Relationships of Fiber Properties to Yarn Properties and to Spinning Efficiency of Medium Staple Cottons

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STATISTICAL RELATIONSHIPS OF FIBER PROPERTIES TO YARN PROPERTIES AND TO SPINNING EFFICIENCY OF MEDIUM-STAPLE COTTONS

By Gain L. Louis and Louis A. Fiori[1]

INTRODUCTION

Because of limited space, many results on an extensive study of 79 medium-staple cottons and the relationship of their fiber properties to yarn properties and to end breakage in spinning were not included when the findings were published (6).[2] This report comprises all the results obtained in the investigation. Cotton textile researchers may use the data presented in this report to relate fiber properties to yarn properties and spinning efficiency.

Fiber-to-fiber, fiber-to-yarn, fiber-to-end breakage, yarn-to-yarn, and yarn-to-end breakage correlation coefficients, simple and multiple, are given. Beta coefficients of fiber properties highly correlated with yarn skein count-strength product and with end breakage are also given. (The reader should consult the "Contents" for the location of these data.)

These relationships should be interpreted with the following qualifications: (1) The relationships were derived from medium-staple cottons and are not applicable to short- and long-staple cottons. (2) The 79 cottons were selected to represent a wide range of fiber properties; a random sample might produce different results. (3) Results from another sample of the same population might be different.

Selection of the 79 cottons was based on Suter-Webb array determinations of the upper-quartile length of homogeneous samples of the raw stock. Only three cottons had upper-quartile lengths of 1.05 inches or less (0.99, 1.04, and 1.05 inches). Therefore, the cottons can be classified as medium-staple 1-1/16-inch cottons.

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[2] Underscored numbers in parentheses refer to items in "Literature Cited" at the end of this report.

The fiber properties of these cottons fell within:

Property	Low	High
Grade	SGO	SM
Fiber length:		
Upper-quartile length, inches	0.99	1.24
Mean length, inches	0.80	1.03
Coefficient of variation, percent	25	39
Short fibers ≤ three-eighths inch, percent	3.3	11.5
Short fibers ≤ one-half inch, percent	5.6	17.7
Digital fibrograph:		
2.5% span length, inches	0.90	1.10
50% span length, inch	0.41	0.54
Uniformity ratio, percent	40	51
Micronaire reading	2.6	7.4
Maturity, NaOH, percent	28	95
Strength:		
Stelometer, 0 gage, grams per tex	30.7	56.2
Stelometer, 1/8-inch gage, grams per tex	18.0	28.1
Bundle elongation, 1/8-inch gage, percent	5.1	10.5
Shirley trash content, percent	1.40	7.37

Cottons were carded at 20 pounds per hour on a metallic wire card with a Crosrol-Varga attachment, except for those having a Micronaire reading of 3.60 and below, which were carded on the same card at 10 pounds per hour. Card slivers were drawn twice with six doublings on a Saco-Lowell Versamatic drawing frame operating at 425 feet per minute and at constant roll settings.

The second-drawing slivers (55 grains per yard) of each cotton were pro-

cessed into 1.20-hank roving for end breakage evaluations on 36/1 (16 tex) yarns using the accelerated and 720 spindle-hour test methods (3, 4). Yarn property and end breakage data were obtained from yarns spun at twist multipliers that yielded maximum yarn strength plus 0.20 (TM + 0.20) unless otherwise specified.

NOMENCLATURE

Definitions and/or references are given for the following not-so-well-known terminologies used in this report:

1. Skewness--Extent to which a fiber frequency distribution diagram deviates from normal or a symmetrical distribution. Calculated by ASTM method (1).

2. OF-length, CM-length, and FU-length--Indices of fiber length distribution derived from fiber length array data (7).

3. Fiber Number--The number of fibers within a given length group of which the average fiber fineness is known (2).

4. Effective Weight--Derived from the concept that fibers three-eighths inch long and shorter and three-sixteenths inch of each fiber tip are noncontributive to yarn strength (9).

5. Alkali Centrifuge Value (ACV)--An index sometimes used to determine degrees of "fiber damage" (8).

6. Code 411--The ratio of skein CSP and single-strand CSP (both items expressed in grams per tex).

7. Yarn Density--Derived from the volume of the full yarn bobbin as measured by the immersion technique (10).

8. Yarn Elongation CV--Calculated from the elongation at break bar diagram made on the Uster single-strand strength tester by grouping the length of the bars in increments of one-third percent (6).

CODES USED IN TABLES

The following codes and abbreviations are used in the tables to identify fiber and yarn properties and end breakage in spinning.

100 Series Codes for Raw-Stock Cotton Fibers

101 Classer's grade.
102 Classer's staple length.
103 Upper-quartile length, by fiber weight (UQL-W).
104 Mean length, by fiber weight (ML-W).
105 Coefficient of variation, by fiber weight (CV-W).
106 Percentage of short fibers less than or equal to three-eighths inch, by fiber weight (% SF $\leq$ 3/8"-W).
107 Percentage of short fibers less than or equal to one-half inch, by fiber weight (% SF $\leq$ 1/2"-W).
108 Skewness of fiber length distribution curve, by fiber weight (W).
109 Upper-quartile length, by fiber number (UQL-N).
110 Mean length, by fiber number (ML-N).
111 Percentage of short fibers less than or equal to three-eighths inch, by fiber number (% SF $\leq$ 3/8"-N).
112 Percentage of short fibers less than or equal to one-half inch, by fiber number (% SF $\leq$ 1/2"-N).
113 2.5% span length.
114 50% span length.
115 Uniformity ratio, or code 114 divided by code 113 times 100.
116 OF-length, by fiber weight (7).
117 CM-length, by fiber weight (7).
118 FU-length, by fiber weight (7).
119 Micronaire reading.
120 Fineness.
121 Maturity.
122 Tenacity, 0 gage, Stelometer (S).
123 Tenacity, 1/8-inch gage, Stelometer (S).
124 Code 123 divided by code 122.
125 Code 122 minus code 123.
126 Code 125 divided by code 122.
127 Code 125 divided by code 123.
128 Fiber elongation at break.
129 Fiber toughness.
130 Fiber stiffness.
131 Percentage of effective weight based on % SF $\leq$ 3/8" (9).
132 Trash content (Shirley analyzer).
133 Alkali Centrifuge value (ACV)(8).

200 Series Codes for Fiber Properties From Second-Drawing Slivers

201 Upper-quartile length, by fiber weight (UQL-W).
202 Mean length, by fiber weight (ML-W).
203 Coefficient of variation, by fiber weight (CV-W).
204 Percentage of short fibers less than or equal to three-eighths inch, by fiber weight (% SF $\leq$ 3/8"-W).

205 Percentage of short fibers less than or equal to one-half inch, by fiber weight (% SF $\leq$ 1/2"-W).
206 2.5% span length.
207 50% span length.
208 Uniformity ratio.
209 OF-length, by fiber weight.
210 CM-length, by fiber weight.
211 FU-length, by fiber weight.
212 Micronaire reading.
213 Tenacity, 0 gage, Stelometer (S).
214 Tenacity, 1/8-inch gage, Stelometer (S).
215 Code 214 divided by code 213.
216 Code 213 minus code 214.
217 Code 216 divided by code 213.
218 Code 216 divided by code 214.
219 Tenacity, 0 gage, Pressley (P).
220 Tenacity, 1/8-inch gage, Pressley (P).
221 Code 220 divided by code 219.
222 Code 219 minus code 220.
223 Fiber elongation at break.
224 Fiber toughness.
225 Fiber stiffness.

300 Series Codes for Fiber Properties From Rovings

301 Upper-quartile length, by fiber weight (UQL-W).
302 Mean length, by fiber weight (ML-W).
303 Coefficient of variation, by fiber weight (CV-W).
304 Percentage of short fibers less than or equal to three-eighths inch, by fiber weight (% SF $\leq$ 3/8"-W).
305 Percentage of short fibers less than or equal to one-half inch, by fiber weight (% SF $\leq$ 1/2"-W).
306 Upper-quartile length, by fiber number (UQL-N).
307 Mean length, by fiber number (ML-N).
308 Percentage of short fibers less than or equal to three-eighths inch, by fiber number (% SF $\leq$ 3/8"-N).
309 Percentage of short fibers less than or equal to one-half inch, by fiber number (% SF $\leq$ 1/2"-N).
310 OF-length, by fiber weight.
311 CM-length, by fiber weight.
312 FU-length, by fiber weight.
313 Micronaire reading.
314 Fineness.
315 Maturity.
316 Tenacity, 0 gage, Stelometer (S).
317 Tenacity, 1/8-inch gage, Stelometer (S).
318 Code 317 divided by code 316.
319 Code 316 minus code 317.

320 Code 319 divided by code 316.
321 Code 319 divided by code 317.
322 Tenacity, 0 gage, Pressley (P).
323 Tenacity, 1/8-inch gage, Pressley (P).
324 Code 323 divided by code 322.
325 Code 322 divided by code 323.
326 Fiber elongation at break.
327 Fiber toughness.
328 Fiber stiffness.
329 Skewness.

400 Series Codes for End Breakages and Yarn Properties

401 End breakage, 720 spindle-hour test method (EB-720SH).
402 End breakage, accelerated test method, at variable TM (EB-AT, VTM).
403 End breakage, accelerated test method, at constant TM of 4.2 (EB-AT, 4.2 TM).
404 Skein count-strength product (CSP).
405 Single-strand count-strength product (SS-CSP).
406 Yarn elongation at break.
407 Yarn toughness.
408 Yarn stiffness.
409 Coefficient of variation of skein breaking strength (CV-SBS).
410 Coefficient of variation of single-strand breaking strength (CV-SSBS).
411 Yarn strength ratio skein count-strength product, in grams per tex, divided by single-strand count-strength product, in grams per tex.
412 Yarn density (10).
413 Maximum yarn skein count-strength product (CSP), calculated from twist-strength curve.
414 Maximum yarn skein strength TM, calculated from twist-strength curve.
415 Uniformity coefficient of variation (long-term).
416 Uniformity coefficient of variation (short-term).
417 Neps per grain of yarn.
418 Yarn grade.
419 Coefficient of variation of skein count-strength product (CV-skein CSP).
420 Coefficient of variation (CV) of yarn elongation at break.

Table 1.--Simple correlation coefficients of fiber properties of raw stock

Code	Independent variable	Dependent variable 101	102	103	104	105	106
101	Classer's grade	1.000	0.236	0.171	0.220	-0.181	-0.244
102	Staple length		1.000	0.529	0.421	-0.017	-0.102
103	UQL-W			1.000	0.797	-0.007	-0.178
104	ML-W				1.000	-0.593	-0.693
105	CV-W					1.000	0.942
106	% SF ≤ 3/8"-W						1.000

		107	108	109	110	111	112
101	Classer's grade	-0.228	-0.016	0.249	0.122	0.011	-0.073
102	Staple length	-0.088	-0.166	0.345	0.088	0.127	0.087
103	UQL-W	-0.150	-0.121	0.652	0.258	0.138	0.107
104	ML-W	-0.691	0.197	0.945	0.678	-0.236	-0.384
105	CV-W	0.968	-0.478	-0.709	-0.821	0.630	0.829
106	% SF ≤ 3/8"-W	0.968	-0.476	-0.792	-0.864	0.674	0.826
107	% SF ≤ 1/2"-W	1.000	-0.459	-0.783	-0.830	0.604	0.810
108	Skewness-W		1.000	-0.233	-0.389	0.364	0.425
109	UQL-N			1.000	0.806	-0.419	-0.564
110	ML-N				1.000	-0.849	-0.913
111	% SF ≤ 3/8"-N					1.000	0.934
112	% SF ≤ 1/2"-N						1.000

		113	114	115	116	117	118
101	Classer's grade	0.094	0.259	0.269	0.183	0.052	0.036
102	Staple length	0.503	0.209	-0.044	0.434	-0.073	-0.082
103	UQL-W	0.792	0.347	-0.060	0.804	-0.161	-0.186
104	ML-W	0.645	0.687	0.417	0.966	0.434	0.397
105	CV-W	-0.006	-0.673	-0.778	-0.542	-0.922	-0.899
106	% SF ≤ 3/8"-W	-0.134	-0.674	-0.701	-0.616	-0.797	-0.762
107	% SF ≤ 1/2"-W	-0.118	-0.690	-0.729	-0.621	-0.845	-0.813
108	Skewness-W	0.015	-0.313	-0.349	-0.086	-0.370	-0.335
109	UQL-N	0.530	0.747	0.554	0.906	0.556	0.526
110	ML-N	0.267	0.662	0.610	0.607	0.661	0.628
111	% SF ≤ 3/8"-N	0.071	-0.330	-0.420	-0.154	-0.500	-0.476
112	% SF ≤ 1/2"-N	0.033	-0.515	-0.616	-0.308	-0.709	-0.684
113	2.5% Span length	1.000	0.515	0.021	0.588	-0.181	-0.216
114	50% Span length		1.000	0.860	0.630	0.563	0.534
115	Uniformity ratio			1.000	0.390	0.759	0.747

Table 1.--Simple correlation coefficients of fiber properties of raw stock--Continued

Code	Independent variable	Dependent variable					
		113	114	115	116	117	118
116	OF-W				1.000	0.453	0.433
117	CM-W					1.000	0.997
118	FU-W						1.000
		119	120	121	122	123	124
101	Classer's grade	0.418	0.310	0.433	0.153	-0.036	-0.288
102	Staple length	-0.087	-0.149	0.014	0.160	0.307	0.219
103	UQL-W	-0.139	-0.254	0.066	0.084	0.256	0.269
104	ML-W	0.177	0.032	0.350	0.254	0.473	0.357
105	CV-W	-0.525	-0.448	-0.505	-0.303	-0.416	-0.197
106	% SF $\leq$ 3/8"-W	-0.499	-0.422	-0.500	-0.244	-0.398	-0.258
107	% SF $\leq$ 1/2"-W	-0.507	-0.427	-0.521	-0.294	-0.432	-0.237
108	Skewness-W	-0.341	-0.330	-0.221	-0.101	-0.194	-0.161
109	UQL-N	0.318	0.186	0.452	0.270	0.448	0.300
110	ML-N	0.369	0.298	0.370	0.163	0.384	0.351
111	% SF $\leq$ 3/8"-N	-0.250	-0.270	-0.132	0.027	-0.172	-0.303
112	% SF $\leq$ 1/2"-N	-0.419	-0.397	-0.336	-0.149	-0.312	-0.259
113	2.5% Span length	0.055	-0.060	0.212	0.081	0.246	0.250
114	50% Span length	0.631	0.422	0.644	0.334	0.389	0.112
115	Uniformity ratio	0.732	0.585	0.656	0.337	0.293	-0.038
116	OF-W	0.123	-0.014	0.300	0.282	0.476	0.318
117	CM-W	0.436	0.375	0.423	0.339	0.416	0.144
118	FU-W	0.420	0.365	0.403	0.344	0.404	0.118
119	Micronaire reading	1.000	0.920	0.871	0.090	-0.049	-0.221
120	Fineness		1.000	0.759	-0.065	-0.167	-0.178
121	Maturity			1.000	0.205	0.077	-0.202
122	Tenacity, 0-gage, S				1.000	0.781	-0.223
123	Tenacity, 1/8"-gage					1.000	0.430
124	123/122						1.000
		125	126	127	128	129	130
101	Classer's grade	0.261	0.287	0.279	-0.166	-0.166	0.025
102	Staple length	-0.021	-0.219	-0.222	-0.269	-0.013	0.241
103	UQL-W	-0.092	-0.264	-0.255	-0.032	0.182	0.116
104	ML-W	-0.021	-0.354	-0.344	-0.051	0.343	0.231
105	CV-W	-0.103	0.199	0.196	0.055	-0.299	-0.215

Table 1.--Simple correlation coefficients of fiber properties of raw stock--Continued

Code	Independent variable	Dependent variable 125	126	127	128	129	130
106	% SF ≤ 3/8"-W	-0.028	0.262	0.251	-0.025	-0.370	-0.153
107	% SF ≤ 1/2"-W	-0.075	0.238	0.231	0.030	-0.337	-0.206
108	Skewness-W	0.013	0.155	0.157	-0.126	-0.289	-0.028
109	UQL-N	0.025	-0.300	-0.297	-0.040	0.332	0.222
110	ML-N	-0.081	-0.357	-0.347	0.077	0.407	0.132
111	% SF ≤ 3/8"-N	0.188	0.313	0.303	-0.231	-0.393	0.050
112	% SF ≤ 1/2"-N	0.041	0.266	0.259	-0.082	-0.354	-0.102
113	2.5% Span length	-0.088	-0.251	-0.238	-0.089	0.109	0.163
114	50% Span length	0.173	-0.117	-0.104	-0.154	0.164	0.275
115	Uniformity ratio	0.259	0.032	0.037	0.152	0.090	0.227
116	OF-W	0.019	-0.315	-0.309	-0.135	0.258	0.280
117	CM-W	0.157	-0.146	-0.149	-0.139	0.201	0.275
118	FU-W	0.174	-0.120	-0.125	-0.155	0.173	0.279
119	Micronaire reading	0.178	0.204	0.190	-0.097	-0.115	0.002
120	Fineness	0.045	0.162	0.147	-0.018	-0.130	-0.099
121	Maturity	0.243	0.182	0.176	-0.215	-0.140	0.141
122	Tenacity, 0-gage, S	0.845	0.242	0.237	-0.692	-0.126	0.860
123	Tenacity, 1/8"-gage	0.326	-0.413	-0.415	-0.433	0.319	0.816
124	123/122	-0.706	-0.997	-0.992	0.352	0.702	0.021
125	122 - 123	1.000	0.721	0.715	-0.677	-0.463	0.603
126	125/122		1.000	0.995	-0.363	-0.701	-0.005
127	125/123			1.000	-0.363	-0.701	-0.006
128	Fiber elongation				1.000	0.709	-0.837
129	Fiber toughness					1.000	-0.268
130	Fiber stiffness						1.000

		131	132	133
101	Classer's grade	0.232	-0.775	-0.488
102	Staple length	0.324	-0.101	0.015
103	UQL-W	0.593	-0.189	0.020
104	ML-W	0.954	-0.293	-0.320
105	CV-W	-0.799	0.246	0.565
106	% SF ≤ 3/8"-W	-0.861	0.302	0.536
107	% SF ≤ 1/2"-W	-0.867	0.285	0.555
108	Skewness-W	-0.313	0.076	0.256
109	UQL-N	0.959	-0.323	-0.444
110	ML-N	0.795	-0.221	-0.409

Table 1.--Simple correlation coefficients of fiber properties of raw stock--Continued

Code	Independent variable	Dependent variable 131	132	133
111	% SF ≤ 3/8"-N	-0.400	0.039	0.212
112	% SF ≤ 1/2"-N	-0.583	0.135	0.398
113	2.5% Span length	0.476	-0.210	-0.108
114	50% Span length	0.747	-0.401	-0.707
115	Uniformity ratio	0.585	-0.371	-0.782
116	OF-W	0.910	-0.246	-0.270
117	CM-W	0.652	-0.132	-0.503
118	FU-W	0.617	-0.106	-0.485
119	Micronaire reading	0.323	-0.541	-0.835
120	Fineness	0.196	-0.391	-0.684
121	Maturity	0.444	-0.595	-0.875
122	Tenacity, 0-gage, S	0.287	-0.124	-0.263
123	Tenacity, 1/8"-gage	0.490	-0.025	-0.143
124	123/122	0.334	0.156	0.177
125	122 - 123	0.015	-0.166	-0.275
126	125/122	-0.333	-0.144	-0.160
127	125/123	-0.324	-0.141	-0.153
128	Fiber elongation	-0.051	0.185	0.185
129	Fiber toughness	0.362	0.148	0.064
130	Fiber stiffness	0.237	-0.084	-0.170
131	% Effective weight at 3/8"	1.000	-0.301	-0.438
132	Trash content		1.000	0.611
133	ACV			1.000

Table 2.--Simple correlation coefficients of raw fiber properties with yarn properties and with end breakage

Code	Independent variable	Dependent variable: EB-720 SH 401	EB-AT VTM 402	EB-AT 4.2 TM 403	Skein CSP 404	SS CSP 405	Elongation 406
101	Classer's grade	-0.338	-0.077	-0.127	-0.004	-0.010	-0.208
102	Staple length	-0.364	-0.336	-0.366	0.275	0.282	-0.147
103	UQL-W	-0.289	-0.477	-0.502	0.364	0.344	0.119
104	ML-W	-0.386	-0.661	-0.669	0.566	0.539	0.110
105	CV-W	0.234	0.429	0.413	-0.412	-0.404	-0.003
106	% SF $\leq$ 3/8"-W	0.224	0.474	0.447	-0.395	-0.385	-0.061
107	% SF $\leq$ 1/2"-W	0.240	0.463	0.437	-0.411	-0.397	-0.001
108	Skewness-W	0.060	-0.082	-0.033	0.090	0.066	0.042
109	UQL-N	-0.411	-0.644	-0.662	0.528	0.506	0.104
110	ML-N	-0.205	-0.501	-0.468	0.411	0.396	0.221
111	% SF $\leq$ 3/8"-N	-0.051	0.237	0.174	-0.154	-0.154	-0.312
112	% SF $\leq$ 1/2"-N	0.083	0.329	0.270	-0.275	-0.266	-0.161
113	2.5% Span length	-0.254	-0.403	-0.413	0.313	0.293	-0.010
114	50% Span length	-0.335	-0.540	-0.524	0.436	0.407	-0.057
115	Uniformity ratio	-0.244	-0.368	-0.348	0.301	0.278	-0.094
116	OF-W	-0.392	-0.630	-0.639	0.571	0.552	0.073
117	CM-W	-0.224	-0.358	-0.337	0.416	0.410	-0.036
118	FU-W	-0.221	-0.337	-0.319	0.405	0.402	-0.045
119	Micronaire reading	-0.094	0.109	0.080	-0.174	-0.185	-0.422
120	Fineness	0.121	0.331	0.310	-0.387	-0.390	-0.480
121	Maturity	-0.298	-0.001	-0.049	-0.010	-0.052	-0.501
122	Tenacity, 0-ga.	-0.390	-0.437	-0.404	0.735	0.720	-0.279
123	Tenacity, 1/8"-ga.	-0.297	-0.586	-0.508	0.823	0.802	0.011
124	123/122	0.134	-0.284	-0.206	0.223	0.213	0.450
125	122 - 123	-0.337	-0.160	-0.176	0.408	0.404	-0.432
126	125/122	-0.145	0.266	0.190	-0.202	-0.191	-0.443
127	125/123	-0.135	0.251	0.177	-0.191	-0.180	-0.423
128	Fiber elongation	0.404	0.174	0.200	-0.388	-0.376	0.608
129	Fiber toughness	0.154	-0.293	-0.209	0.239	0.234	0.630
130	Fiber stiffness	-0.333	-0.384	-0.350	0.668	0.650	-0.335
131	% Eff.wt.at 3/8"	-0.370	-0.644	-0.644	0.555	0.534	0.077
132	Trash content	0.287	0.100	0.161	-0.024	-0.004	0.218
133	ACV	0.303	0.128	0.140	-0.084	-0.047	0.285

Table 2.--Simple correlation coefficients of raw fiber properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Tough-ness 407	Stiff-ness 408	CV-SBS 409	CV-SSBS 410	Yarn strength ratio 411	Yarn Density 412
101	Classer's grade	-0.119	0.101	0.056	-0.090	0.042	0.183
102	Staple length	0.148	0.302	-0.025	-0.336	0.183	0.231
103	UQL-W	0.321	0.218	0.141	-0.302	0.324	0.346
104	ML-W	0.461	0.409	-0.005	-0.404	0.465	0.657
105	CV-W	-0.303	-0.366	0.185	0.253	-0.278	-0.598
106	% SF $\leq$ 3/8"-W	-0.320	-0.306	0.173	0.260	-0.269	-0.624
107	% SF $\leq$ 1/2"-W	-0.297	-0.360	0.163	0.240	-0.291	-0.605
108	Skewness-W	0.063	0.033	-0.153	-0.142	0.108	0.255
109	UQL-N	0.431	0.386	-0.031	-0.418	0.420	0.699
110	ML-N	0.413	0.214	-0.160	-0.397	0.295	0.617
111	% SF $\leq$ 3/8"-N	-0.279	0.059	0.203	0.264	-0.060	-0.334
112	% SF $\leq$ 1/2"-N	-0.287	-0.139	0.214	0.247	-0.170	-0.439
113	2.5% Span length	0.220	0.257	-0.024	-0.359	0.260	0.373
114	50% Span length	0.272	0.410	-0.047	-0.350	0.363	0.688
115	Uniformity ratio	0.154	0.322	-0.047	-0.170	0.259	0.574
116	OF-W	0.452	0.442	0.051	-0.371	0.452	0.602
117	CM-W	0.288	0.403	-0.149	-0.182	0.280	0.519
118	FU-W	0.277	0.402	-0.131	-0.166	0.264	0.490
119	Micronaire reading	-0.350	0.084	-0.112	0.184	-0.111	0.356
120	Fineness	-0.530	-0.071	-0.079	0.306	-0.299	0.230
121	Maturity	-0.292	0.263	-0.137	0.133	0.117	0.458
122	Tenacity, 0-ga.	0.381	0.877	0.073	-0.226	0.528	0.033
123	Tenacity, 1/8"-ga.	0.598	0.749	0.010	-0.336	0.601	0.223
124	123/122	0.395	-0.109	-0.083	-0.201	0.166	0.290
125	122 - 123	0.065	0.686	0.102	-0.054	0.284	-0.141
126	125/122	-0.375	0.124	0.088	0.189	-0.156	-0.301
127	125/123	-0.356	0.122	0.088	0.169	-0.150	-0.291
128	Fiber elongation	0.028	-0.744	-0.005	0.140	-0.320	0.156
129	Fiber toughness	0.493	-0.191	-0.022	-0.120	0.144	0.369
130	Fiber stiffness	0.306	0.845	0.045	-0.258	0.499	-0.025
131	% Eff.wt.at 3/8"	0.439	0.426	-0.064	-0.374	0.434	0.697
132	Trash content	0.112	-0.125	0.049	0.053	-0.104	-0.304
133	ACV	0.113	-0.225	0.078	0.052	-0.169	-0.498

Table 2.--Simple correlation coefficients of raw fiber properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Max. skein CSP 413	Max. skein TM 414	Uniformity CV 415	Uniformity CV 416	Neps/gr. yarn 417	Yarn grade 418	CV-skein CSP 419
101	Classer's grade	0.018	0.300	-0.235	-0.291	-0.444	-0.357	0.089
102	Staple length	0.300	-0.147	-0.218	-0.245	-0.033	-0.006	0.069
103	UQL-W	0.405	-0.331	-0.311	-0.331	-0.031	0.040	0.189
104	ML-W	0.616	-0.370	-0.647	-0.649	-0.298	-0.373	0.002
105	CV-W	-0.438	0.126	0.628	0.615	0.455	0.681	0.231
106	% SF $\leq$ 3/8"-W	-0.420	0.153	0.628	0.608	0.474	0.634	0.206
107	% SF $\leq$ 1/2"-W	-0.436	0.129	0.609	0.606	0.465	0.633	0.205
108	Skewness-W	0.084	-0.067	-0.184	-0.195	-0.224	-0.190	-0.086
109	UQL-N	0.586	-0.266	-0.705	-0.704	-0.424	-0.505	-0.062
110	ML-N	0.424	-0.250	-0.623	-0.604	-0.370	-0.571	-0.186
111	% SF $\leq$ 3/8"-N	-0.127	0.169	0.342	0.300	0.188	0.410	0.250
112	% SF $\leq$ 1/2"-N	-0.264	0.124	0.460	0.432	0.321	0.551	0.258
113	2.5% Span length	0.345	-0.207	-0.294	-0.331	-0.137	-0.028	0.056
114	50% Span length	0.492	-0.020	-0.668	-0.641	-0.518	-0.613	-0.070
115	Uniformity ratio	0.349	0.142	-0.595	-0.546	-0.545	-0.702	-0.123
116	OF-W	0.622	-0.361	-0.613	-0.608	-0.236	-0.316	0.049
117	CM-W	0.440	-0.118	-0.580	-0.543	-0.372	-0.618	-0.222
118	FU-W	0.429	-0.106	-0.558	-0.521	-0.349	-0.600	-0.209
119	Micronaire reading	-0.123	0.613	-0.200	-0.204	-0.739	-0.658	-0.136
120	Fineness	-0.344	0.677	-0.010	-0.005	-0.664	-0.564	-0.118
121	Maturity	0.052	0.550	-0.326	-0.362	-0.842	-0.619	-0.159
122	Tenacity, 0-ga.	0.733	-0.123	-0.280	-0.324	-0.073	-0.117	0.053
123	Tenacity, 1/8"-ga.	0.797	-0.420	-0.314	-0.349	0.087	-0.062	-0.013
124	123/122	0.185	-0.487	-0.072	-0.064	0.252	0.084	-0.091
125	122 - 123	0.427	0.173	-0.155	-0.192	-0.185	-0.124	0.091
126	125/122	-0.167	0.464	0.069	0.062	-0.244	-0.074	0.099
127	125/123	-0.157	0.440	0.058	0.057	0.239	-0.074	0.104
128	Fiber elongation	-0.387	-0.144	0.146	0.160	0.155	0.035	-0.002
129	Fiber toughness	0.220	-0.477	-0.120	-0.129	0.206	-0.049	-0.018
130	Fiber stiffness	0.652	-0.142	-0.209	-0.240	-0.009	0.003	-0.001
131	% Eff.wt.at 3/8"	0.602	-0.306	-0.704	-0.695	-0.391	-0.526	-0.073
132	Trash content	-0.042	-0.354	0.300	0.376	0.572	0.440	0.035
133	ACV	-0.148	-0.408	0.435	0.468	0.773	0.688	0.145

Table 3.--Simple correlation coefficients of second-drawing sliver properties with yarn properties and with end breakage

Code	Independent variable	Dependent variable: EB-720 SH 401	EB-AT VTM 402	EB-AT 4.2 TM 403	Skein CSP 404	SS CSP 405	Elongation 406
201	UQL-W	-0.469	-0.636	-0.636	0.526	0.511	0.093
202	ML-W	-0.504	-0.738	-0.729	0.640	0.622	0.033
203	CV-W	0.300	0.463	0.447	-0.435	-0.432	0.071
204	% SF $\leq$ 3/8"-W	0.310	0.479	0.466	-0.403	-0.410	0.034
205	% SF $\leq$ 1/2"-W	0.342	0.541	0.522	-0.474	-0.474	0.045
206	2.5% Span length	-0.364	-0.556	-0.568	0.438	0.419	-0.005
207	50% Span length	-0.381	-0.617	-0.596	0.517	0.498	-0.015
208	Uniformity ratio	-0.286	-0.434	-0.412	0.394	0.381	-0.045
209	OF-W	-0.503	-0.693	-0.682	0.629	0.609	0.005
210	CM-W	-0.238	-0.360	-0.343	0.379	0.365	-0.092
211	FU-W	-0.216	-0.314	-0.298	0.342	0.328	-0.097
212	Micronaire reading	-0.094	0.125	0.090	-0.199	-0.217	-0.435
213	Tenacity, 0-ga. S	-0.408	-0.429	-0.406	0.695	0.702	-0.308
214	Tenacity, 1/8"-ga.S	-0.365	-0.625	-0.560	0.845	0.833	-0.022
215	214/213	0.040	-0.304	-0.249	0.309	0.293	0.411
216	213 - 214	-0.287	-0.064	-0.090	0.269	0.290	-0.466
217	216/213	-0.028	0.381	0.309	-0.339	-0.314	-0.435
218	216/214	-0.026	0.371	0.303	-0.333	-0.308	-0.425
219	Tenacity, 0-ga. P	-0.335	-0.362	-0.338	0.688	0.675	-0.330
220	Tenacity, 1/8"-ga.P	-0.305	-0.607	-0.539	0.850	0.851	0.086
221	220/219	0.001	-0.412	-0.339	0.340	0.359	0.583
222	219/220	-0.212	0.023	-0.003	0.232	0.213	-0.564
223	Fiber elongation	0.387	0.124	0.150	-0.296	-0.310	0.605
224	Fiber toughness	0.067	-0.349	-0.281	0.324	0.302	0.555
225	Fiber stiffness	-0.373	-0.383	-0.360	0.633	0.636	-0.378

Code	Independent variable	Toughness 407	Stiffness 408	CV-SBS 409	CV-SSBS 410	Yarn strength ratio 411	Yarn density 412
201	UQL-W	0.430	0.386	0.080	-0.444	0.411	0.478
202	ML-W	0.483	0.538	-0.042	-0.497	0.484	0.721
203	CV-W	-0.287	-0.445	0.147	0.274	-0.282	-0.617
204	% SF $\leq$ 3/8"-W	-0.291	-0.391	0.135	0.347	-0.229	-0.626
205	% SF $\leq$ 1/2"-W	-0.334	-0.461	0.111	0.339	-0.297	-0.630
206	2.5% Span length	0.314	0.373	0.006	-0.311	0.352	0.546
207	50% Span length	0.360	0.472	-0.104	-0.375	0.388	0.720
208	Uniformity ratio	0.254	0.394	-0.125	-0.287	0.280	0.534
209	OF-W	0.456	0.544	0.007	-0.467	0.481	0.677
210	CM-W	0.223	0.404	-0.111	-0.222	0.279	0.537

Table 3.--Simple correlation coefficients of second-drawing sliver properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Tough-ness 407	Stiff-ness 408	CV-SBS 409	CV-SSBS 410	Yarn strength ratio 411	Yarn Density 412
211	FU-W	0.193	0.374	-0.096	-0.192	0.256	0.492
212	Micronaire reading	-0.382	0.066	-0.111	0.220	-0.104	0.345
213	Tenacity, 0-ga. S	0.352	0.876	0.063	-0.296	0.425	0.165
214	Tenacity, 1/8"-ga. S	0.600	0.802	0.056	-0.286	0.580	0.271
215	214/213	0.449	-0.022	0.012	0.004	0.247	0.034
216	213 - 214	-0.034	0.597	0.045	-0.186	0.101	-0.007
217	216/213	-0.459	-0.0004	-0.001	0.015	-0.300	-0.197
218	216/214	-0.449	-0.001	0.009	0.025	-0.295	-0.199
219	Tenacity, 0-ga. P	0.321	0.861	-0.006	-0.212	0.469	0.066
220	Tenacity, 1/8"-ga.P	0.672	0.751	0.067	-0.332	0.529	0.291
221	220/219	0.571	-0.042	0.113	-0.212	0.158	0.304
222	219 - 220	-0.143	0.578	-0.070	-0.007	0.205	-0.169
223	Fiber elongation	0.082	-0.687	-0.041	0.181	-0.161	0.153
224	Fiber toughness	0.509	-0.085	-0.025	-0.031	0.270	0.368
225	Fiber stiffness	0.266	0.866	0.097	-0.256	0.402	-0.001

		Maximum skein CSP 413	Maximum skein TM 414	Uniformity CV 415	Uniformity CV 416	Neps/gr. Yarn 417	Yarn grade 418
201	UQL-W	0.570	-0.391	-0.505	-0.511	-0.114	-0.057
202	ML-W	0.694	-0.349	-0.765	-0.764	-0.375	-0.465
203	CV-W	-0.468	0.114	0.676	0.649	0.479	0.667
204	% SF $\leq$ 3/8"-W	-0.432	0.134	0.676	0.646	0.476	0.618
205	% SF $\leq$ 1/2"-W	-0.507	0.156	0.682	0.667	0.467	0.631
206	2.5% Span length	0.500	-0.241	-0.458	-0.465	-0.281	-0.251
207	50% Span length	0.578	-0.122	-0.731	-0.714	-0.536	-0.699
208	Uniformity ratio	0.429	0.004	-0.633	-0.609	-0.498	-0.711
209	OF-W	0.683	-0.341	-0.738	-0.716	-0.336	-0.418
210	CM-W	0.414	-0.073	-0.590	-0.552	-0.428	-0.642
211	FU-W	0.377	-0.051	-0.549	-0.503	-0.408	-0.616
212	Micronaire reading	-0.143	0.644	-0.186	-0.191	-0.761	-0.675
213	Tenacity 0-ga. S	0.712	-0.083	-0.377	-0.402	-0.199	-0.254
214	Tenacity, 1/8"-ga. S	0.850	-0.353	-0.359	-0.387	-0.048	-0.223
215	214/213	0.272	-0.395	0.046	0.032	0.244	0.055
216	213 - 214	0.291	0.216	-0.243	-0.255	-0.268	-0.182
217	216/213	-0.323	0.447	0.021	0.030	-0.229	-0.008
218	216/214	-0.317	0.441	0.018	0.032	-0.226	-0.007
219	Tenacity, 0-ga. P	0.680	-0.080	-0.299	-0.330	-0.150	-0.177
220	Tenacity, 1/8"-ga. P	0.859	-0.438	-0.389	-0.386	0.032	-0.217

Table 3.--Simple correlation coefficients of second-drawing sliver properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Maximum skein CSP 413	Maximum skein TM 414	Uniformity CV 415	Uniformity CV 416	Neps/gr. Yarn 417	Yarn Grade 418
221	220/219	0.359	-0.536	-0.159	-0.116	0.268	-0.084
222	219 - 220	0.213	0.284	-0.084	-0.131	-0.249	-0.062
223	Fiber elongation	-0.317	-0.259	0.162	0.160	0.182	0.102
224	Fiber toughness	0.306	-0.503	-0.130	-0.144	0.108	-0.101
225	Fiber stiffness	0.650	-0.021	-0.245	-0.265	-0.092	-0.129

		Skein CSP - CV 419	Yarn Elongation CV 420
201	UQL-W	0.126	-0.336
202	ML-W	-0.023	-0.333
203	CV-W	0.168	0.161
204	% SF $\leq$ 3/8"-W	0.144	0.124
205	% SF $\leq$ 1/2"-W	0.116	0.156
206	2.5% Span length	0.075	-0.175
207	50% Span length	-0.131	-0.221
208	Uniformity ratio	-0.197	-0.168
209	OF-W	0.012	-0.352
210	CM-W	-0.156	-0.157
211	FU-W	-0.147	-0.150
212	Micronaire reading	-0.126	0.301
213	Tenacity, 0-ga. S	0.021	-0.199
214	Tenacity, 1/8"-ga. S	0.035	-0.340
215	214/213	0.018	-0.241
216	213 - 214	-0.002	0.020
217	216/213	-0.025	0.262
218	216/214	-0.012	0.250
219	Tenacity, 0-ga. P	-0.039	-0.160
220	Tenacity, 1/8"-ga. P	0.044	-0.441
221	220/219	0.120	-0.445
222	219 - 220	-0.098	0.168
223	Fiber elongation	-0.011	-0.148
224	Fiber toughness	0.006	-0.377
225	Fiber stiffness	0.036	-0.082

Table 4.--Simple correlation coefficients of roving-fiber properties with yarn properties and with end breakage

Code	Independent variable	Dependent variable: EB-720 SH 401	EB-AT VTM 402	EB-AT 4.2 TM 403	Skein CSP 404	SS CSP 405	Elongation 406
301	UQL-W	-0.453	-0.704	-0.694	0.580	0.565	0.167
302	ML-W	-0.451	-0.737	-0.709	0.619	0.596	0.104
303	CV-W	0.221	0.392	0.369	-0.318	-0.300	0.021
304	% SF $\leq$ 3/8"-W	0.234	0.421	0.401	-0.314	-0.309	-0.026
305	% SF $\leq$ 1/2"-W	0.273	0.494	0.474	-0.391	-0.378	-0.018
306	UQL-N	-0.396	-0.615	-0.622	0.473	0.452	-0.004
307	ML-N	-0.212	-0.423	-0.425	0.282	0.282	0.029
308	% SF $\leq$ 3/8"-N	0.035	0.195	0.198	-0.083	-0.104	-0.072
309	% SF $\leq$ 1/2"-N	0.117	0.298	0.302	-0.185	-0.194	-0.014
310	OF-W	-0.444	-0.718	-0.691	0.636	0.615	0.102
311	CM-W	-0.207	-0.372	-0.341	0.364	0.344	-0.021
312	FU-W	-0.197	-0.354	-0.327	0.354	0.334	-0.019
313	Micronaire reading	-0.098	0.118	0.091	-0.190	-0.208	-0.424
314	Fineness	0.159	0.347	0.328	-0.423	-0.422	-0.457
315	Maturity	-0.245	0.060	0.010	-0.087	-0.127	-0.474
316	Tenacity, 0-ga. S	-0.401	-0.367	-0.351	0.650	0.645	-0.311
317	Tenacity, 1/8"-ga. S	-0.297	-0.578	-0.514	0.801	0.796	-0.003
318	317/316	0.118	-0.312	-0.243	0.256	0.258	0.366
319	316 - 317	-0.307	-0.020	-0.052	0.226	0.223	-0.431
320	319/316	-0.129	0.311	0.239	-0.260	-0.264	-0.387
321	319/317	-0.090	0.337	0.273	-0.286	-0.293	-0.407
322	Tenacity, 0-ga. P	-0.363	-0.469	-0.445	0.728	0.733	-0.162
323	Tenacity 1/8"-ga. P	-0.264	-0.569	-0.488	0.829	0.823	0.065
324	323/322	0.105	-0.265	-0.163	0.304	0.291	0.351
325	322 - 323	-0.325	-0.184	-0.224	0.304	0.329	-0.243
326	Fiber elongation	0.440	0.126	0.164	-0.318	-0.323	0.621
327	Fiber toughness	0.167	-0.326	-0.244	0.290	0.280	0.588
328	Fiber stiffness	-0.372	-0.371	-0.354	0.643	0.647	-0.376
329	Skewness	-0.028	-0.227	-0.161	0.268	0.262	-0.038

Code	Independent variable	Toughness 407	Stiffness 408	CV-SBS 409	CV-SSBS 410	Yarn strength ratio 411	Yarn density 412
301	UQL-W	0.510	0.393	0.043	-0.439	0.446	0.489
302	ML-W	0.503	0.472	-0.080	-0.439	0.483	0.713
303	CV-W	-0.217	-0.291	0.173	0.217	-0.253	-0.595
304	% SF $\leq$ 3/8"-W	-0.247	-0.265	0.151	0.239	-0.207	-0.608
305	% SF $\leq$ 1/2"-W	-0.292	-0.339	0.151	0.263	-0.285	-0.614

Table 4.--Simple correlation coefficients of roving-fiber properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Tough-ness 407	Stiff-ness 408	CV-SBS 409	CV-SSBS 410	Yarn strength ratio 411	Yarn density 412
306	UQL-N	0.336	0.416	-0.044	-0.402	0.383	0.692
307	ML-N	0.227	0.240	-0.027	-0.315	0.184	0.582
308	% SF ≤ 3/8"-N	-0.118	-0.050	-0.007	0.192	0.023	-0.334
309	% SF ≤ 1/2"-N	-0.152	-0.174	0.053	0.222	-0.082	-0.490
310	OF-W	0.516	0.491	-0.069	-0.441	0.492	0.664
311	CM-W	0.250	0.339	-0.162	-0.218	0.288	0.539
312	FU-W	0.243	0.329	-0.156	-0.212	0.283	0.513
313	Micronaire reading	-0.369	0.068	-0.119	0.225	-0.101	0.351
314	Fineness	-0.543	-0.113	-0.085	0.336	-0.337	0.209
315	Maturity	-0.335	0.176	-0.166	0.106	0.058	0.449
316	Tenacity, 0-ga. S	0.312	0.822	0.038	-0.060	0.453	0.038
317	Tenacity, 1/8"-ga. S	0.582	0.752	0.041	-0.273	0.513	0.307
318	317/316	0.377	-0.006	0.018	-0.273	0.109	0.356
319	316 - 317	-0.059	0.508	0.018	0.149	0.196	-0.208
320	319/316	-0.392	0.013	-0.021	0.279	-0.102	-0.353
321	319/317	-0.422	-0.002	-0.028	0.310	-0.117	-0.364
322	Tenacity,0-ga. P	0.448	0.806	-0.046	-0.197	0.453	0.144
323	Tenacity, 1/8"-ga. P	0.636	0.738	0.078	-0.243	0.540	0.140
324	323/322	0.400	0.043	0.191	-0.124	0.217	0.026
325	322 - 323	0.106	0.476	-0.144	-0.124	0.123	0.163
326	Fiber elongation	0.077	-0.704	-0.026	0.050	-0.214	0.154
327	Fiber toughness	0.507	-0.122	-0.017	-0.154	0.182	0.408
328	Fiber stiffness	0.277	0.870	0.091	-0.188	0.401	0.030
329	Skewness	0.186	0.263	-0.089	-0.085	0.162	0.313

		Maximum skein CSP 413	Maximum skein TM 414	Uniform. CV (LT) 415	Uniform. CV (ST) 416	Neps/gr. of yarn 417	Yarn grade 418
301	UQL-W	0.626	-0.412	-0.527	-0.514	0.124	-0.122
302	ML-W	0.658	-0.341	-0.758	-0.733	-0.374	-0.547
303	CV-W	-0.335	0.068	0.639	0.601	0.488	0.708
304	% SF ≤ 3/8"-W	-0.333	0.087	0.624	0.597	0.488	0.677
305	% SF ≤ 1/2"-W	-0.415	0.101	0.653	0.634	0.474	0.696
306	UQL-N	0.522	-0.181	-0.737	-0.696	-0.445	-0.648
307	ML-N	0.304	-0.190	-0.581	-0.539	-0.274	-0.513
308	% SF ≤ 3/8"-N	-0.077	0.144	0.334	0.294	0.089	0.318
309	% SF ≤ 1/2"-N	-0.198	0.096	0.477	0.442	0.265	0.534
310	OF-W	0.675	-0.338	-0.760	-0.724	-0.331	-0.497

Table 4.--Simple correlation coefficients of roving-fiber properties with yarn properties and with end breakage--Continued

Code	Independent variable	Dependent variable: Maximum skein CSP 413	Maximum skein TM 414	Uniform. CV (LT) 415	Uniform. CV (ST) 416	Neps/gr. of yarn 417	Yarn grade 418
311	CM-W	0.376	-0.084	-0.629	-0.591	-0.407	-0.680
312	FU-W	0.366	-0.074	-0.616	-0.577	-0.390	-0.657
313	Micronaire reading	-0.133	0.634	-0.182	-0.190	-0.767	-0.685
314	Fineness	-0.380	0.685	0.024	0.041	-0.614	-0.547
315	Maturity	-0.027	0.568	-0.298	-0.319	-0.821	-0.636
316	Tenacity, 0-ga. S	0.654	-0.043	-0.276	-0.308	-0.161	-0.175
317	Tenacity, 1/8"-ga. S	0.808	-0.371	-0.365	-0.405	-0.011	-0.189
318	317/316	0.261	-0.415	-0.130	-0.143	0.182	-0.036
319	316 - 317	0.226	0.256	-0.075	-0.086	-0.216	-0.083
320	319/316	-0.262	0.433	0.129	0.142	-0.194	0.039
321	319/317	-0.289	0.447	0.151	0.167	-0.200	0.042
322	Tenacity, 0-ga. P	0.726	-0.163	-0.356	-0.389	-0.092	-0.149
323	Tenacity, 1/8"-ga. P	0.823	-0.427	-0.274	-0.298	0.141	-0.061
324	323/322	0.296	-0.460	0.063	0.076	0.378	0.106
325	322 - 323	0.313	0.180	-0.307	-0.342	-0.291	-0.191
326	Fiber elongation	-0.331	-0.218	0.153	0.168	0.192	0.059
327	Fiber toughness	0.284	-0.488	-0.147	-0.157	0.149	-0.117
328	Fiber stiffness	0.654	-0.064	-0.257	-0.296	-0.084	-0.106
329	Skewness	0.246	-0.145	-0.236	-0.231	-0.189	-0.347

Code	Independent variable	Skein CSP CV 419
301	UQL-W	0.064
302	ML-W	-0.077
303	CV-W	0.210
304	% SF $\leq$ 3/8"-W	0.186
305	% SF $\leq$ 1/2"-W	0.181
306	UQL-N	-0.043
307	ML-N	-0.017
308	% SF $_$ 3/8"-N	-0.026
309	% SF $_$ 1/2"-N	0.047
310	OF-W	-0.091
311	CM-W	-0.211
312	FU-W	-0.213
313	Micronaire reading	-0.135
314	Fineness	-0.093
315	Maturity	-0.201
316	Tenacity, 0-ga. S	0.016
317	Tenacity, 1/8"-ga. S	0.016
318	317/316	0.003
319	316 - 317	0.009
320	319/316	-0.005
321	319/317	-0.001
322	Tenacity, 0-ga. P	-0.044
323	Tenacity, 1/8"-ga. P	0.058
324	323/322	0.146
325	322 - 323	-0.121
326	Fiber elongation	-0.017
327	Fiber toughness	-0.010
328	Fiber stiffness	0.033
329	Skewness	-0.052

Table 5.-- Simple correlation coefficients of yarn properties with end breakage in spinning

Code	Independent variable	Dependent variable 401	402	403	404	405	406
401	EB-720 SH	1.000	0.570	0.668	-0.506	-0.490	0.109
402	EB-AT (VTM)		1.000	0.957	-0.831	-0.824	-0.348
403	EB-AT (4.2 TM)			1.000	-0.779	-0.774	-0.278
404	Skein CSP				1.000	0.981	0.206
405	SS CSP					1.000	0.252
406	Yarn elongation						1.000

		407	408	409	410	411	412
401	EB-720 SH	-0.312	-0.492	0.114	0.376	-0.470	-0.281
402	EB-AT (VTM)	-0.785	-0.543	0.019	0.599	-0.615	-0.476
403	EB-AT (4.2 TM)	-0.710	-0.538	0.003	0.584	-0.589	-0.493
404	Skein CSP	0.830	0.788	-0.036	-0.534	0.738	0.329
405	SS CSP	0.867	0.777	-0.008	-0.538	0.596	0.299
406	Yarn elongation	0.696	-0.402	0.038	-0.296	-0.012	0.099
407	Yarn toughness	1.000	0.363	0.004	-0.542	0.436	0.269
408	Yarn stiffness		1.000	-0.009	-0.318	0.563	0.208
409	Skein Strength CV			1.000	0.022	-0.123	-0.186
410	SS Strength CV				1.000	-0.363	-0.385
411	Yarn strength ratio					1.000	0.324
412	Yarn density						1.000

		413	414	415	416	417	418
401	EB-720 SH	-0.536	0.096	0.561	0.587	0.393	0.345
402	EB-AT (VTM)	-0.857	0.598	0.727	0.709	0.055	0.304
403	EB-AT (4.2 TM	-0.817	0.516	0.762	0.738	0.116	0.358
404	Skein CSP	0.984	-0.625	-0.575	-0.595	0.046	-0.140
405	SS CSP	0.970	-0.624	-0.548	-0.570	0.088	-0.125
406	Yarn elongation	0.178	-0.630	-0.133	-0.113	0.394	0.128
407	Yarn toughness	0.805	-0.790	-0.470	-0.474	0.260	-0.030
408	Yarn stiffness	0.798	-0.174	-0.419	-0.457	-0.148	-0.191
409	Skein strength CV	-0.022	0.004	0.165	0.219	0.230	0.055
410	SS strength CV	-0.530	0.516	0.610	0.604	-0.003	0.163
411	Yarn strength ratio	0.710	-0.430	-0.509	-0.514	-0.109	-0.149
412	Yarn density	0.396	-0.213	-0.737	-0.739	-0.473	-0.567
413	Maximum skein CSP	1.000	-0.593	-0.621	-0.641	-0.013	-0.202
414	Maximum skein TM		1.000	0.351	0.318	-0.459	-0.191
415	Uniformity CV (LT)			1.000	0.929	0.429	0.583

Table 5.--Simple correlation coefficients of yarn properties with end breakage in spinning--Continued

Code	Independent variable	Dependent variable 416	417	418
416	Uniformity CV (ST)	1.000	0.450	0.555
417	Neps/gr. of yarn		1.000	0.690
418	Yarn grade			1.000
419	Skein CSP CV			
420	Yarn elongation CV			

		419	420
401	EB-720 SH	0.064	0.312
402	EB-AT (VTM)	0.019	0.575
403	EB-AT (4.2 TM)	0.002	0.546
404	Skein CSP	-0.038	-0.539
405	SS CSP	-0.020	-0.543
406	Yarn elongation	0.010	-0.580
407	Yarn toughness	-0.012	-0.690
408	Yarn stiffness	-0.024	-0.132
409	Skein strength CV	0.907	-0.004
410	SS strength CV	0.048	0.512
411	Yarn strength ratio	-0.086	-0.366
412	Yarn density	-0.192	-0.243
413	Maximum skein CSP	-0.033	-0.547
414	Maximum skein TM	-0.0002	0.611
415	Uniformity CV (LT)	0.191	0.449
416	Uniformity CV (ST)	0.239	0.414
417	Neps/gr. of yarn	0.243	-0.145
418	Yarn grade	0.090	0.056
419	Skein CSP CV	1.000	-0.010
420	Yarn elongation CV		1.000

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.534	0.566	0.522	0.522	0.522	0.493	0.519	0.552	0.520	0.557	0.513
402	EB-AT VTM	0.651	0.766	0.690	0.718	0.704	0.535	0.638	0.832	0.738	0.733	0.625
403	EB-AT 4.2 TM	0.636	0.751	0.661	0.677	0.666	0.497	0.609	0.791	0.692	0.718	0.593
404	Skein CSP	0.835	0.895	0.875	0.874	0.870	0.802	0.839	0.910	0.867	0.885	0.857
405	SS CSP	0.819	0.875	0.864	0.863	0.857	0.788	0.824	0.889	0.849	0.869	0.846
406	Yarn elongation	0.754	0.764	0.782	0.778	0.771	0.756	0.755	0.803	0.826	0.764	0.776
409	Skein Strength CV	0.190	0.147	0.258	0.244	0.238	0.214	0.147	0.147	0.145	0.150	0.220
410	SS strength CV	0.414	0.153	0.519	0.513	0.493	0.422	0.482	0.652	0.536	0.474	0.439
415	Uniformity CV (LT)	0.476	0.668	0.707	0.692	0.673	0.418	0.461	0.751	0.740	0.643	0.664
416	Uniformity CV (ST)	0.547	0.696	0.730	0.704	0.703	0.505	0.547	0.743	0.709	0.673	0.681

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus tenacity, 0-gage (122), fiber elongation (128), trash content (132), and micronaire reading (119).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. Ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.553	0.594	0.585	0.581	0.583	0.529	0.549	0.599	0.584	0.585	0.571
402	EB-AT VTM	0.675	0.793	0.769	0.795	0.782	0.601	0.672	0.844	0.784	0.762	0.701
403	EB-AT 4.2 TM	0.662	0.782	0.750	0.764	0.752	0.570	0.648	0.812	0.750	0.750	0.678
404	Skein CSP	0.852	0.911	0.914	0.914	0.908	0.833	0.857	0.917	0.889	0.901	0.894
405	SS CSP	0.836	0.891	0.902	0.901	0.894	0.817	0.841	0.895	0.870	0.885	0.882
406	Yarn elongation	0.786	0.792	0.819	0.816	0.808	0.791	0.786	0.817	0.841	0.792	0.813
409	Skein str. CV	0.182	0.124	0.265	0.248	0.242	0.212	0.124	0.132	0.130	0.126	0.222
410	SS str. CV	0.439	0.532	0.566	0.561	0.542	0.475	0.499	0.630	0.545	0.497	0.488
415	Unif. CV (LT)	0.467	0.669	0.753	0.735	0.716	0.439	0.463	0.751	0.756	0.643	0.705
416	Unif. CV (ST)	0.545	0.701	0.771	0.743	0.743	0.528	0.553	0.745	0.727	0.677	0.718

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus tenacity, 0-gage (122), fiber elongation (128), trash content (132), and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.525	0.564	0.517	0.517	0.518	0.492	0.509	0.550	0.518	0.552	0.509
402	EB-AT VTM	0.700	0.765	0.711	0.727	0.717	0.646	0.686	0.834	0.771	0.741	0.677
403	EB-AT 4.2 TM	0.659	0.742	0.667	0.677	0.668	0.581	0.632	0.788	0.711	0.713	0.622
404	Skein CSP	0.863	0.883	0.879	0.874	0.872	0.856	0.862	0.905	0.894	0.880	0.875
405	SS CSP	0.843	0.862	0.862	0.857	0.854	0.837	0.842	0.881	0.872	0.860	0.858
406	Yarn elongation	0.777	0.778	0.788	0.784	0.781	0.777	0.778	0.806	0.830	0.778	0.787
409	Skein str. CV	0.171	0.107	0.231	0.220	0.209	0.175	0.110	0.108	0.113	0.124	0.182
410	SS str. CV	0.451	0.516	0.521	0.514	0.497	0.461	0.500	0.652	0.543	0.485	0.461
415	Unif. CV (LT)	0.493	0.664	0.711	0.696	0.677	0.458	0.479	0.754	0.739	0.637	0.663
416	Unif. CV (ST)	0.553	0.686	0.729	0.701	0.702	0.530	0.550	0.741	0.710	0.660	0.677

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), micronaire reading (119), tenacity, 1/8"-gage (123).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.545	0.596	0.589	0.586	0.588	0.526	0.540	0.602	0.585	0.583	0.571
402	EB-AT VTM	0.722	0.795	0.782	0.801	0.789	0.689	0.718	0.855	0.817	0.772	0.738
403	EB-AT 4.2 TM	0.684	0.777	0.752	0.764	0.753	0.633	0.672	0.815	0.767	0.748	0.697
404	Skein CSP	0.884	0.906	0.921	0.915	0.912	0.883	0.885	0.929	0.927	0.903	0.914
405	SS CSP	0.864	0.885	0.904	0.898	0.894	0.863	0.865	0.906	0.905	0.883	0.896
406	Yarn elongation	0.810	0.807	0.823	0.820	0.814	0.809	0.810	0.823	0.845	0.807	0.820
409	Skein str. CV	0.163	0.083	0.238	0.226	0.215	0.173	0.088	0.085	0.083	0.101	0.184
410	SS str. CV	0.475	0.535	0.563	0.558	0.540	0.502	0.520	0.626	0.548	0.507	0.501
415	Unif. CV (LT)	0.479	0.667	0.762	0.747	0.726	0.466	0.474	0.753	0.750	0.636	0.705
416	Unif. CV (ST)	0.549	0.692	0.777	0.749	0.749	0.545	0.552	0.745	0.728	0.664	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), tenacity, 1/8"-gage (123), and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.519	0.582	0.524	0.525	0.526	0.465	0.497	0.560	0.518	0.565	0.507
402	EB-AT VTM	0.569	0.726	0.664	0.689	0.678	0.480	0.533	0.817	0.743	0.680	0.592
403	EB-AT 4.2 TM	0.570	0.730	0.644	0.659	0.649	0.447	0.521	0.783	0.695	0.683	0.567
404	Skein CSP	0.612	0.749	0.757	0.749	0.749	0.600	0.598	0.803	0.771	0.720	0.718
405	SS CSP	0.594	0.727	0.747	0.739	0.736	0.578	0.580	0.778	0.748	0.703	0.708
406	Yarn elongation	0.750	0.757	0.779	0.774	0.768	0.754	0.750	0.800	0.830	0.757	0.774
409	Skein str. CV	0.215	0.150	0.187	0.177	0.169	0.175	0.137	0.151	0.161	0.177	0.165
410	SS str. CV	0.421	0.512	0.523	0.514	0.497	0.449	0.469	0.651	0.552	0.474	0.455
415	Unif. CV (LT)	0.438	0.672	0.712	0.701	0.680	0.398	0.413	0.757	0.739	0.637	0.663
416	Unif. CV (ST)	0.486	0.693	0.735	0.710	0.710	0.460	0.475	0.747	0.708	0.656	0.672

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), micronaire reading (119), and 123/122 (124).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF ≤3/8"-W	% SF ≤1/2"-W	Skewness-W	Span length 2.5%	Span length 50%	Unif. ratio	OF-length-W	CM-length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.543	0.613	0.596	0.595	0.596	0.516	0.536	0.608	0.586	0.597	0.576
402	EB-AT VTM	0.609	0.766	0.769	0.790	0.778	0.582	0.598	0.846	0.813	0.725	0.699
403	EB-AT 4.2 TM	0.610	0.769	0.749	0.762	0.751	0.553	0.589	0.812	0.770	0.728	0.677
404	Skein CSP	0.665	0.792	0.849	0.841	0.839	0.692	0.664	0.843	0.840	0.766	0.812
405	SS CSP	0.647	0.770	0.837	0.828	0.824	0.669	0.646	0.818	0.816	0.749	0.799
406	Yarn elongation	0.800	0.799	0.825	0.820	0.814	0.803	0.800	0.824	0.852	0.799	0.821
409	Skein str. CV	0.204	0.120	0.186	0.174	0.165	0.167	0.111	0.112	0.112	0.149	0.160
410	SS str. CV	0.460	0.536	0.570	0.563	0.547	0.510	0.503	0.631	0.570	0.506	0.511
415	Unif. CV (LT)	0.420	0.676	0.754	0.742	0.721	0.422	0.411	0.752	0.752	0.639	0.705
416	Unif. CV (ST)	0.482	0.701	0.777	0.753	0.751	0.495	0.484	0.746	0.729	0.663	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), fineness (120), and 123/122 (124).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF ≤3/8"-W	% SF ≤1/2"-W	Skew-ness-W	Span length 2.5%	Span length 50%	Unif. ratio	OF-length-W	CM-length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.529	0.574	0.523	0.524	0.525	0.472	0.511	0.556	0.519	0.564	0.511
402	EB-AT VTM	0.529	0.739	0.657	0.692	0.678	0.347	0.495	0.820	0.717	0.689	0 .555
403	EB-AT 4.2 TM	0.559	0.744	0.645	0.665	0.653	0.355	0.512	0.787	0.680	0.698	0.549
404	Skein CSP	0.626	0.809	0.791	0.792	0.789	0.569	0.622	0.839	0.765	0.777	0.737
405	SS CSP	0.614	0.790	0 .785	0.785	0.779	0.554	0.610	0.816	0.746	0.763	0.731
406	Yarn elongation	0.727	0.749	0.775	0 .770	0.762	0.733	0.726	0.799	0.825	0.747	0.766
409	Skein str. CV	0.228	0.173	0 .230	0.218	0.213	0.217	0.171	0.172	0.172	0.188	0.210
410	SS str. CV	0.379	0.510	0.519	0.511	0.493	0.406	0.450	0.651	0.543	0.465	0.431
415	Unif. CV (LT)	0.430	0.672	0.708	0.695	0.675	0 .364	0 .405	0.751	0.741	0.644	0.663
416	Unif. CV (ST)	0.493	0.701	0 .734	0.709	0.708	0.444	0.487	0.747	0.708	0.670	0.677

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), micronaire reading (119), and 122 - 123 (125).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.551	0.602	0.587	0.585	0.586	0.521	0.545	0.601	0.584	0.592	0.573
402	EB-AT VTM	0.571	0.773	0.760	0.788	0.775	0.498	0.561	0.837	0.784	0.728	0.671
403	EB-AT 4.2 TM	0.597	0.777	0.797	0.762	0.750	0.497	0.576	0.810	0.754	0.736	0.664
404	Skein CSP	0.668	0.835	0.862	0.862	0.857	0.664	0.673	0.850	0.814	0.807	0.814
405	SS CSP	0.655	0.815	0.853	0.852	0.845	0.646	0.660	0.828	0.793	0.793	0.805
406	Yarn elongation	0.773	0.785	0.820	0.815	0.808	0.785	0.773	0.817	0.846	0.784	0.813
409	Skein str. CV	0.217	0.145	0.228	0.213	0.207	0.209	0.144	0.146	0.147	0.160	0.203
410	SS str. CV	0.419	0.532	0.569	0.562	0.545	0.480	0.481	0.633	0.562	0.494	0.495
415	Unif. CV (LT)	0.419	0.675	0.748	0.733	0.713	0.403	0.411	0.750	0.757	0.645	0.705
416	Unif. CV (ST)	0.493	0.707	0.771	0.747	0.745	0.487	0.509	0.746	0.728	0.676	0.718

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus 122 - 123 (125), fiber elongation (128), trash content (132), and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables: UQL-W	ML-W	CV-W	% SF 3/8"-W	% SF 1/2"-W	Skewness-W	Span length 2.5%	Span length 50%	Unif. ratio	OF-length-W	CM-length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.520	0.585	0.525	0.527	0.528	0.465	0.498	0.563	0.518	0.567	0.509
402	EB-AT VTM	0.562	0.725	0.662	0.688	0.677	0.470	0.525	0.817	0.741	0.678	0.587
403	EB-AT 4.2 TM	0.566	0.731	0.643	0.658	0.648	0.438	0.516	0.783	0.693	0.683	0.563
404	Skein CSP	0.607	0.748	0.756	0.748	0.748	0.594	0.591	0.802	0.769	0.718	0.715
405	SS CSP	0.587	0.726	0.746	0.738	0.735	0.572	0.573	0.777	0.745	0.701	0.705
406	Yarn elongation	0.748	0.756	0.778	0.773	0.767	0.752	0.748	0.800	0.829	0.755	0.773
409	Skein str. CV	0.217	0.153	0.188	0.177	0.170	0.177	0.139	0.153	0.154	0.180	0.167
410	SS str. CV	0.418	0.512	0.522	0.513	0.497	0.447	0.467	0.651	0.551	0.473	0.453
415	Unif. CV (LT)	0.437	0.672	0.712	0.701	0.680	0.397	0.411	0.757	0.739	0 637	0.663
416	Unif. CV (ST)	0.485	0.693	0.734	0.710	0.709	0.459	0.473	0.747	0.708	0.656	0.672

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), micronaire reading (119), and 125/122 (126).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.544	0.615	0.597	0.597	0.598	0.516	0.537	0.610	0.587	0.599	0.577
402	EB-AT VTM	0.604	0.765	0.767	0.789	0.777	0.577	0.592	0.844	0.810	0.723	0.696
403	EB-AT 4.2 TM	0.607	0.770	0.749	0.761	0.750	0.549	0.585	0.812	0.767	0.727	0.765
404	Skein CSP	0.660	0.791	0.848	0.840	0.839	0.689	0.659	0.841	0.838	0.764	0.810
405	SS CSP	0.642	0.769	0.836	0.828	0.824	0.665	0.641	0.816	0.813	0.747	0.797
406	Yarn elongation	0.798	0.797	0.824	0.819	0.813	0.802	0.798	0.823	0.851	0.797	0.820
409	Skein str. CV	0.207	0.123	0.187	0.174	0.166	0.169	0.115	0.116	0.115	0.152	0.161
410	SS str. CV	0.457	0.536	0.569	0.562	0.546	0.509	0.501	0.630	0.568	0.504	0.509
415	Unif. CV (LT)	0.419	0.676	0.753	0.742	0.720	0.422	0.410	0.752	0.752	0.640	0.705
416	Unif. CV (ST)	0.481	0.701	0.777	0.753	0.751	0.495	0.483	0.746	0.729	0.663	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), 125/122 (126), and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.519	0.580	0.522	0.523	0.525	0.465	0.497	0.558	0.517	0.564	0.507
402	EB-AT VTM	0.559	0.725	0.661	0.688	0.677	0.466	0.523	0.817	0.742	0.677	0.584
403	EB-AT 4.2 TM	0.565	0.731	0.643	0.658	0.648	0.436	0.515	0.783	0.694	0.683	0.562
404	Skein CSP	0.604	0.748	0.755	0.748	0.748	0.592	0.589	0.803	0.770	0.717	0.714
405	SS CSP	0.585	0.726	0.746	0.738	0.735	0.570	0.572	0.778	0.746	0.700	0.704
406	Yarn elongation	0.745	0.754	0.777	0.772	0.766	0.750	0.745	0.800	0.829	0.753	0.772
409	Skein str. CV	0.212	0.146	0.187	0.176	0.168	0.175	0.134	0.146	0.148	0.174	0.164
410	SS str. CV	0.412	0.511	0.521	0.512	0.495	0.442	0.464	0.651	0.549	0.470	0.449
415	Unif. CV (LT)	0.435	0.673	0.713	0.701	0.680	0.394	0.409	0.756	0.739	0.638	0.663
416	Unif. CV (ST)	0.485	0.693	0.734	0.709	0.709	0.458	0.473	0.745	0.708	0.657	0.672

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), micronaire reading (119), and 125/123 (127).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF ≤3/8"-W	% SF ≤1/2"-W	Skew-ness-W	Span length 2.5%	Span length 50%	Unif. ratio	OF-length-W	CM-length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.542	0.610	0.594	0.593	0.594	0.516	0.536	0.606	0.585	0.595	0.575
402	EB-AT VTM	0.602	0.765	0.767	0.789	0.777	0.575	0.591	0.845	0.812	0.723	0.695
403	EB-AT 4.2 TM	0.606	0.770	0.749	0.762	0.751	0.548	0.585	0.813	0.769	0.727	0.675
404	Skein CSP	0.659	0.791	0.848	0.840	0.839	0.689	0.658	0.842	0.839	0.764	0.809
405	SS CSP	0.641	0.769	0.836	0.828	0.824	0.665	0.641	0.817	0.815	0.747	0.797
406	Yarn elongation	0.796	0.795	0.823	0.819	0.812	0.800	0.797	0.823	0.851	0.795	0.819
409	Skein str. CV	0.202	0.117	0.186	0.174	0.165	0.167	0.109	0.110	0.110	0.146	0.159
410	SS str. CV	0.453	0.534	0.567	0.561	0.545	0.505	0.498	0.630	0.567	0.502	0.506
415	Unif. CV (LT)	0.417	0.677	0.754	0.742	0.720	0.421	0.408	0.751	0.752	0.640	0.705
416	Unif. CV (ST)	0.481	0.700	0.776	0.752	0.750	0.495	0.483	0.746	0.730	0.664	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), trash content (132), fineness (120), and 125/123 (127).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.408	0.512	0.445	0.433	0.446	0.318	0.381	0.502	0.443	0.499	0.427
402	EB-AT VTM	0.534	0.707	0.637	0.649	0.649	0.395	0.515	0.814	0.725	0.676	0.572
403	EB-AT 4.2 TM	0.533	0.710	0.618	0.621	0.620	0.361	0.497	0.777	0.677	0.674	0.544
404	Skein CSP	0.426	0.634	0.645	0.600	0.626	0.350	0.427	0.732	0.679	0.628	0.625
405	SS CSP	0.412	0.614	0.641	0.596	0.617	0.337	0.413	0.707	0.657	0.613	0.619
406	Yarn elongation	0.745	0.744	0.741	0.741	0.742	0.741	0.745	0.745	0.759	0.744	0.741
409	Skein str. CV	0.176	0.109	0.192	0.186	0.172	0.165	0.108	0.111	0.117	0.130	0.156
410	SS str. CV	0.362	0.495	0.507	0.492	0.477	0.368	0.439	0.651	0.530	0.454	0.422
415	Unif. CV (LT)	0.430	0.661	0.710	0.694	0.675	0.368	0.413	0.751	0.739	0.634	0.663
416	Unif. CV (ST)	0.486	0.680	0.728	0.696	0.700	0.442	0.484	0.741	0.708	0.653	0.673

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus trash content (132), micronaire reading (119), toughness (129).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.447	0.556	0.558	0.546	0.556	0.407	0.443	0.571	0.546	0.541	0.532
402	EB-AT VTM	0.584	0.752	0.752	0.768	0.762	0.522	0.586	0.840	0.789	0.722	0.686
403	EB-AT 4.2 TM	0.582	0.755	0.738	0.745	0.739	0.495	0.572	0.807	0.750	0.721	0.664
404	Skein CSP	0.515	0.697	0.775	0.741	0.757	0.514	0.530	0.780	0.762	0.689	0.748
405	SS CSP	0.502	0.676	0.767	0.733	0.745	0.497	0.516	0.756	0.741	0.674	0.739
406	Yarn elongation	0.767	0.766	0.758	0.758	0.760	0.758	0.767	0.759	0.766	0.765	0.758
409	Skein str. CV	0.169	0.085	0.193	0.186	0.172	0.161	0.086	0.084	0.084	0.107	0.153
410	SS str. CV	0.409	0.521	0.560	0.553	0.535	0.449	0.475	0.625	0.540	0.486	0.484
415	Unif. CV (LT)	0.416	0.665	0.757	0.745	0.722	0.399	0.415	0.751	0.750	0.634	0.705
416	Unif. CV (ST)	0.485	0.687	0.776	0.749	0.748	0.481	0.495	0.745	0.728	0.659	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus trash content (132), toughness (129) and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.475	0.501	0.458	0.453	0.456	0.437	0.456	0.491	0.464	0.501	0.457
402	EB-AT VTM	0.587	0.742	0.673	0.703	0.689	0.463	0.547	0.819	0.729	0.697	0.587
403	EB-AT 4.2 TM	0.591	0.734	0.648	0.662	0.652	0.439	0.540	0.781	0.686	0.695	0.567
404	Skein CSP	0.743	0.835	0.829	0.827	0.822	0.717	0.728	0.857	0.825	0.815	0.797
405	SS CSP	0.723	0.812	0.816	0.813	0.806	0.697	0.710	0.832	0.802	0.796	0.784
406	Yarn elongation	0.560	0.616	0.667	0.672	0.652	0.594	0.557	0.695	0.722	0.597	0.629
409	Skein str. CV	0.174	0.118	0.209	0.192	0.187	0.173	0.121	0.118	0.120	0.128	0.182
410	SS str. CV	0.420	0.517	0.521	0.513	0.497	0.436	0.475	0.648	0.539	0.479	0.446
415	Unif. CV (LT)	0.444	0.661	0.702	0.681	0.666	0.391	0.417	0.751	0.740	0.635	0.662
416	Unif. CV (ST)	0.502	0.684	0.725	0.695	0.697	0.467	0.490	0.740	0.708	0.656	0.673

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus trash content (132), micronaire reading (119), and stiffness (130).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.496	0.533	0.524	0.514	0.519	0.476	0.491	0.545	0.534	0.532	0.521
402	EB-AT VTM	0.620	0.777	0.767	0.792	0.779	0.563	0.603	0.840	0.785	0.736	0.687
403	EB-AT 4.2 TM	0.624	0.771	0.747	0.757	0.747	0.542	0.599	0.809	0.751	0.735	0.671
404	Skein CSP	0.774	0.864	0.894	0.890	0.885	0.777	0.769	0.885	0.872	0.846	0.862
405	SS CSP	0.755	0.842	0.879	0.875	0.868	0.755	0.751	0.861	0.849	0.827	0.848
406	Yarn elongation	0.617	0.657	0.720	0.727	0.708	0.660	0.617	0.703	0.731	0.643	0.687
409	Skein str. CV	0.167	0.096	0.211	0.192	0.187	0.169	0.100	0.099	0.097	0.106	0.182
410	SS str. CV	0.449	0.536	0.562	0.556	0.540	0.489	0.501	0.625	0.545	0.504	0.495
415	Unif. CV (LT)	0.429	0.663	0.746	0.722	0.708	0.418	0.418	0.752	0.752	0.635	0.706
416	Unif. CV (ST)	0.499	0.690	0.769	0.736	0.739	0.501	0.498	0.745	0.727	0.661	0.717

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fineness (120), trash content (132), and stiffness (130).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-	Span length		Unif.	OF-	CM-
					≤3/8"-W	≤1/2"-W	ness-W	2.5%	50%	ratio	length-W	length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.584	0.597	0.549	0.555	0.553	--	0.568	0.565	0.539	--	--
402	EB-AT VTM	0.685	0.777	0.689	0.728	0.710	--	0.675	0.825	0.713	--	--
403	EB-AT 4.2 TM	0.662	0.757	0.642	0.674	0.657	--	0.634	0.773	0.649	--	--
404	Skein CSP	0.847	0.898	0.875	0.878	0.873	--	0.852	0.909	0.861	--	--
405	SS CSP	0.825	0.876	0.861	0.863	0.856	--	0.830	0.888	0.843	--	--
406	Yarn elongation	0.793	0.779	0.790	0.790	0.783	--	0.773	0.806	0.819	--	--
409	Skein str. CV	0.191	0.147	0.259	0.244	0.238	--	0.147	0.147	0.146	--	--
410	SS str. CV	0.500	0.561	0.553	0.558	0.539	--	0.559	0.658	0.538	--	--
415	Unif. CV (LT)	0.607	0.730	0.745	0.750	0.727	--	0.598	0.768	0.731	--	--
416	Unif. CV (ST)	0.662	0.758	0.755	0.756	0.746	--	0.661	0.756	0.697	--	--

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus tenacity, 0-gage (122), fiber elongation (128), micronaire reading (119), and alkali centrifuge value (133).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

		Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					≤3/8"-W	≤1/2"-W		2.5%	50%			
Code	Dependent variables	103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.636	0.652	0.635	0.640	0.638	--	0.629	0.631	0.619	--	--
402	EB-AT VTM	0.717	0.806	0.777	0.809	0.793	--	0.712	0.843	0.776	--	--
403	EB-AT 4.2 TM	0.701	0.794	0.747	0.773	0.757	--	0.684	0.806	0.732	--	--
404	Skein CSP	0.863	0.912	0.916	0.917	0.911	--	0.868	0.917	0.889	--	--
405	SS CSP	0.841	0.890	0.902	0.901	0.894	--	0.847	0.898	0.871	--	--
406	Yarn elongation	0.800	0.802	0.823	0.822	0.814	--	0.800	0.818	0.840	--	--
409	Skein str. CV	0.197	0.140	0.265	0.248	0.242	--	0.141	0.141	0.140	--	--
410	SS str. CV	0.503	0.562	0.585	0.588	0.569	--	0.549	0.630	0.546	--	--
415	Unif. CV (LT)	0.623	0.739	0.792	0.793	0.771	--	0.616	0.763	0.752	--	--
416	Unif. CV (ST)	0.676	0.767	0.800	0.797	0.788	--	0.675	0.755	0.722	--	--

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus tenacity, 0-gage (122), fiber elongation (128), alkali centrifuge value (133), and fineness (120).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF ≤3/8"-W	% SF ≤1/2"-W	Skewness-W	Span length 2.5%	Span length 50%	Unif. ratio	OF-length-W	CM-length-W
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.583	0.606	0.550	0.558	0.555	--	0.566	0.568	0.539	--	--
402	EB-AT VTM	0.723	0.777	0.710	0.736	0.720	--	0.710	0.827	0.748	--	--
403	EB-AT 4.2 TM	0.678	0.751	0.649	0.675	0.659	--	0.649	0.771	0.670	--	--
404	Skein CSP	0.872	0.889	0.881	0.880	0.877	--	0.871	0.905	0.889	--	--
405	SS CSP	0.847	0.864	0.861	0.859	0.855	--	0.846	0.880	0.867	--	--
406	Yarn elongation	0.788	0.789	0.795	0.795	0.790	--	0.788	0.808	0.823	--	--
409	Skein str. CV	0.167	0.107	0.233	0.221	0.211	--	0.110	0.108	0.112	--	--
410	SS str. CV	0.516	0.562	0.551	0.557	0.538	--	0.566	0.657	0.542	--	--
415	Unif. CV (LT)	0.612	0.735	0.752	0.761	0.736	--	0.603	0.774	0.727	--	--
416	Unif. CV (ST)	0.663	0.760	0.760	0.763	0.753	--	0.661	0.759	0.698	--	--

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), micronaire reading (119), tenacity 1/8"-gage (123), and alkali centrifuge value (133).

Table 6.--Multiple correlation coefficients of fiber and yarn properties and end breakage in spinning--Continued

Code	Dependent variables	Independent variables [1]										
		UQL-W	ML-W	CV-W	% SF		Skew-ness-W	Span length		Unif. ratio	OF-length-W	CM-length-W
					<3/8"-W	<1/2"-W		2.5%	50%			
		103	104	105	106	107	108	113	114	115	116	117
401	EB-720 SH	0.637	0.661	0.640	0.648	0.645	--	0.630	0.634	0.618	--	--
402	EB-AT VTM	0.761	0.813	0.790	0.815	0.801	--	0.755	0.853	0.807	--	--
403	EB-AT 4.2 TM	0.722	0.792	0.749	0.773	0.758	--	0.706	0.808	0.747	--	--
404	Skein CSP	0.901	0.917	0.926	0.923	0.920	--	0.902	0.930	0.926	--	--
405	SS CSP	0.875	0.890	0.906	0.902	0.898	--	0.876	0.906	0.903	--	--
406	Yarn elongation	0.818	0.816	0.827	0.825	0.820	--	0.818	0.825	0.844	--	--
409	Skein str. CV	0.161	0.090	0.240	0.225	0.216	--	0.095	0.090	0.092	--	--
410	SS str. CV	0.522	0.562	0.576	0.580	0.561	--	0.562	0.625	0.547	--	--
415	Unif. CV (LT)	0.630	0.742	0.796	0.802	0.777	--	0.624	0.763	0.743	--	--
416	Unif. CV (ST)	0.681	0.769	0.805	0.805	0.795	--	0.680	0.755	0.721	--	--

[1] Multiple correlation coefficients calculated with the variable given in the boxheads plus fiber elongation (128), tenacity 1/8"-gage (123), alkaline centrifuge value (133), and fineness (120).

Table 7.--Relative effects of fiber properties and yarn skein strength expressed in terms of beta coefficients

Multiple correlation coefficient[1]	Coefficient of determination	Independent variables											
		ML-W	CV-W	% SF		50% span length	Unif. ratio	Fineness	Tenacity		Elongation	Trash content	ACV
				≤3/8"-W	≤1/2"-W				0-gage	1/8"-gage			
R	R^2	104	105	106	107	114	115	120	122	123	128	132	133
0.930	0.865	--	--	--	--	0.381	--	-0.498	--	0.561	-0.070	--	-0.073
0.929	0.863	--	--	--	--	0.406	--	-0.471	--	0.565	-0.072	-0.029	--
0.927	0.859	--	--	--	--	--	0.416	-0.544	--	0.597	-0.050	-0.070	--
0.926	0.857	--	-0.334	--	--	--	--	-0.581	--	0.518	-0.106	--	-0.208
0.926	0.857	--	--	--	--	--	0.394	-0.552	--	0.590	-0.057	--	-0.068
0.923	0.851	--	--	-0.315	--	--	--	-0.569	--	0.522	-0.129	--	-0.215
0.921	0.848	--	-0.379	--	--	--	--	-0.494	--	0.539	-0.112	-0.101	--
0.920	0.846	--	--	--	-0.299	--	--	-0.563	--	0.528	-0.109	--	-0.217
0.917	0.841	--	--	--	--	0.509	--	-0.566	0.589	--	0.085	0.016	--
0.917	0.841	--	--	-0.466	--	--	--	-0.634	0.536	--	-0.016	--	-0.124
0.917	0.841	--	--	--	--	0.534	--	-0.536	0.600	--	0.088	--	0.068
0.917	0.841	0.226	--	--	--	--	--	-0.432	--	0.591	-0.075	--	-0.219
0.916	0.839	--	-0.473	--	--	--	--	-0.651	0.525	--	0.014	--	-0.126
0.915	0.837	--	--	-0.354	--	--	--	-0.460	--	0.547	-0.144	-0.068	--

[1] Dependent variable = Yarn skein CSP (404); Independent variables = fiber properties listed above.

Table 7.--Relative effects of fiber properties and yarn skein strength expressed in terms of beta coefficients--Continued

Multiple correlation coefficient[1]	Coefficient of determination	Independent variables											
		ML-W	CV-W	% SF		50% span length	Unif. ratio	Fineness	Tenacity		Elongation	Trash content	ACV
				≤3/8"-W	≤1/2"-W				0-gage	1/8"-gage			
R	R^2	104	105	106	107	114	115	119	122	123	128	132	133
0.905	0.819	--	--	--	--	0.446	--	-0.525	--	0.573	-0.091	--	-0.122
0.905	0.819	--	--	--	--	0.465	--	-0.477	--	0.588	-0.084	-0.080	--
0.894	0.799	--	--	--	--	--	0.439	-0.526	--	0.649	-0.056	-0.136	--
0.881	0.776	--	-0.261	--	--	--	--	-0.485	--	0.619	-0.096	--	-0.249
0.889	0.790	--	--	--	--	--	0.387	-0.524	--	0.643	-0.068	--	-0.013
0.880	0.774	--	--	-0.250	--	--	--	-0.477	--	0.620	-0.115	--	-0.252
0.879	0.773	--	-0.293	--	--	--	--	-0.360	--	0.651	-0.090	-0.129	--
0.877	0.769	--	--	--	-0.232	--	--	-0.470	--	0.628	-0.098	--	-0.253
0.910	0.828	--	--	--	--	0.614	--	-0.657	0.655	--	0.106	-0.076	--
0.874	0.764	--	--	-0.429	--	--	--	-0.641	0.648	--	0.026	--	-0.228
0.909	0.826	--	--	--	--	0.607	--	-0.662	0.642	--	0.092	--	-0.061
0.889	0.790	0.264	--	--	--	--	--	-0.364	--	0.619	-0.092	--	-0.211
0.875	0.766	--	-0.426	--	--	--	--	-0.653	0.645	--	0.058	--	-0.233
0.874	0.764	--	--	-0.261	--	--	--	-0.319	--	0.662	-0.109	-0.097	--

[1] Dependent variable = Yarn skein CSP (404); Independent variables = Fiber properties listed above.

Table 8.--Relative effects of fiber properties on end breakage in spinning expressed in terms of beta coefficients

Multiple correlation coefficient[1] R	Coefficient of determination R^2	Independent variables												
		50% span length	Micronaire rdg.	Fineness	Tenacity 0-gage	Tenacity 1/8"-gage	122 - 123	125/122	125/123	Elongation	Toughness	Stiffness	Trash content	ACV
		114	119	120	122	123	125	126	127	128	129	130	132	133
0.855	0.731	-0.705	--	0.624	--	-0.238	--	--	--	-0.044	--	--	0.068	--
0.853	0.728	-0.718	--	0.621	--	-0.225	--	--	--	-0.031	--	--	--	0.022
0.846	0.716	-0.788	--	0.673	--	-0.137	--	--	--	0.103	--	--	0.056	--
0.845	0.714	-0.793	--	0.678	--	--	--	--	0.134	0.103	--	--	0.055	--
0.844	0.712	-0.776	--	0.680	-0.168	--	--	--	--	-0.057	--	--	0.045	--
0.844	0.712	-0.793	--	0.679	--	--	--	0.124	--	0.100	--	--	0.053	--
0.843	0.711	-0.798	--	0.659	-0.166	--	--	--	--	-0.048	--	--	--	-0.020
0.840	0.706	-0.813	--	0.703	--	--	--	--	--	--	-0.086	--	0.064	--
0.840	0.706	-0.805	--	0.694	--	--	--	--	--	--	--	-0.095	0.042	--
0.837	0.701	-0.834	--	0.716	--	--	-0.002	--	--	0.051	--	--	0.036	--
0.834	0.696	-0.833	0.709	--	--	-0.238	--	--	--	-0.017	--	--	0.157	--
0.832	0.692	-0.900	0.785	--	-0.247	--	--	--	--	-0.082	--	--	0.154	--
0.827	0.684	-0.819	0.738	--	--	-0.216	--	--	--	0.001	--	--	--	0.142
0.825	0.681	-0.886	0.797	--	-0.221	--	--	--	--	-0.055	--	--	--	0.124
0.820	0.672	-0.989	0.847	--	--	--	-0.119	--	--	0.033	--	--	0.145	--

[1] Dependent variable = End breakage (spinning)(402); Independent variables = Fiber properties listed above.

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